

**MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures**

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SOP TITLE: Collection of Samples from Drums

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SUMMARY OF REVISIONS: Minor revisions were made throughout the document.

APPLICABILITY: The procedures contained within this SOP are applicable to ESP field staff who participate in drum investigations.

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1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) provides technical guidance for conducting drum investigations. While these procedures are specifically written for investigating drums, they may also be applicable to other types of non-pressurized containers such as totes, 5-gallon buckets, paint cans, or jugs. These procedures do not apply to pressurized cylinders. ESP field staff should not open pressurized containers for sampling or any other reason due to the extreme hazards associated with pressurized cylinders. A hazardous materials contractor that specializes in dealing with pressurized cylinders should be employed in the event that ESP field staff have a need to open or collect a sample from a pressurized cylinder.

Drum investigations can be very dangerous and often involve handling and opening containers of concentrated hazardous wastes or products. Abandoned drum investigations are particularly dangerous since they generally involve unknown materials and often located outdoors where ESP field staff may be subjected to adverse weather and other hazardous field conditions. While this SOP does not address all the potential health and safety hazards associated with working around hazardous substances, it does address many of the unique aspects of dealing with containerized hazardous substances. This SOP will provide guidance to ESP field staff in developing both a sampling plan and a health and safety plan for a drum investigation.

The procedures described within this SOP provide guidance on conducting an initial site survey and taking a drum inventory prior to opening any drums. The procedures include recommendations for site screening instrumentation and the use of personal protective equipment. Drum handling and sampling procedures are also discussed. A particular emphasis has been placed upon health and safety issues as they relate to each of the procedures described within this SOP.

2.0 DEFINITIONS AND ACRONYMS

- APR - Air Purifying Respirator
- Buddy System - A safety system where each person works directly with another, or a "buddy", in a two-person team. Each person in a team should always maintain visual contact with his partner, with an emphasis on always being aware of each other's whereabouts in the event an accident or problem should occur.
- HASP - Health and Safety Plan
- HAZWOPER – Hazardous Waste Operations and Emergency Response (from OSHA 1910.120)
- PID (Photoionization Detector) - A portable air monitoring instrument used to measure the amount of ionizable organic vapors present.
- SCBA - Self-Contained Breathing Apparatus
- Thief tube - A four-foot long hollow glass tube that comes in various diameters and is used to collect a liquid sample from a drum.

3.0 HEALTH AND SAFETY WARNINGS

The health and safety warnings described below are not listed in any particular order and should all be considered when conducting a drum investigation.

- 3.1 The "buddy system" should always be used during a drum investigation.
- 3.2 Spark-resistant tools should be used when opening drums. Bungs should always be loosened slowly to allow for controlled venting of gases that may be under pressure. Extreme caution should be used when attempting to open any drum that appears swollen or under pressure. A full drum under pressure can spew liquid contents if the pressure is not released slowly.
- 3.3 Since flammable liquids are often encountered during drum investigations, all electronic instruments used during a drum investigation should be rated as intrinsically-safe (i.e., equipment that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration). In reality, not all electronic equipment that may be needed to conduct a drum investigation are rated intrinsically-safe (e.g., radiation meter). However, such common items unnecessary to an investigation such as pagers, cellular phones, radios, and other equipment not rated as intrinsically-safe **MUST NOT** be in the work zone when drums of flammable liquids are being opened or sampled. An explosimeter should be used to monitor a work zone to ensure that explosive levels do not reach levels of concern (i.e., > 10% LEL).
- 3.4 Level B personal protection should be worn when opening drums of unknown materials. ESP field staff may downgrade only when the hazard is known and has been determined safe for a less protective level of personal protection.
- 3.5 Unless the contents of a drum are known, samples collected from drums should always be considered hazardous waste samples and should not be chemically preserved due to the potential for a severe reaction. Drum samples should be preserved on ice as soon as collected and should be packed in a cooler in such a manner to prevent container breakage.
- 3.6 Prior to moving or opening any drum, ESP field staff should visually inspect the condition of the drum looking for evidence of any corrosion, damage, leakage, and excessive internal pressure such as swelling. Any markings, labels, or other written information should be read and assessed to help determine the possible contents of the drum. However, any information learned from drum markings or labels may not be accurate and should always be considered suspect.
- 3.7 ESP field staff should never stand or walk on drums due to the danger of collapse or breakthrough. Sometimes drums must be moved to create aisle space for access. A drum dolly should be used. Care should be taken when moving any heavy object such as a drum.

- 3.8 Closed-top drums, or drums that have bungs for access, are designed to contain liquids. Open-top, or ring-top, drums are designed to contain solid materials. Polyethylene drums often contain strong acids or bases. Metal (steel) drums often contain solvents. Drums made of exotic materials such as stainless steel, aluminum, or nickel, are expensive and often used to store extremely dangerous materials.
- 3.9 Because of the need to wear level B or C personal protective equipment, adverse weather conditions (i.e., extreme cold or hot and humid weather, windy or rainy conditions, icy or slick conditions) must be considered when deciding whether or not a drum investigation should even be conducted. If at all possible, drum investigations should be conducted when the weather is relatively mild and the risk of frostbite or heat stress is either minimal or non-existent. If working in extreme weather conditions cannot be avoided then the site specific HASP must address the weather conditions and describe specific procedures to monitor and protect ESP field staff from suffering cold or heat related illnesses.
- 3.10 For any sampling investigation that occurs at a hazardous waste site, site specific health and safety requirements should be described in a written HASP. A site safety meeting should be held by the person in charge of the sampling investigation and should take place in the field prior to conducting any fieldwork. All ESP field staff directly involved in the fieldwork should read and sign the HASP. The HASP should be kept in the field in a location readily available to all ESP field staff. The role and level of participation of any non-ESP field staff present on-site, such as Hazardous Waste Program or Regional Office staff, must be clearly delineated and discussed prior to work being conducted. Anyone directly involved in the fieldwork (e.g., opening drums or collecting samples) must meet the Personnel Qualifications specified in Section 4.0.

4.0 PERSONNEL QUALIFICATIONS

4.1 Hazardous Waste Operations and Emergency Response (HAZWOPER) Site Work

All ESP field staff that are directly involved in field investigations at sites that meet the definition of HAZWOPER activities and thus fall under the EPA Worker Protection requirements of 40 CFR Part 311 must meet the qualifications listed below. Most drum investigations would meet the definition of HAZWOPER site work.

- 4.2 ESP field staff must meet the following qualifications to actively participate in a drum investigation:
- Staff must attend a 40-hour course designed to meet the OSHA health and safety training requirements for hazardous site workers.
 - Staff must attend an annual 8-hour health and safety refresher course, or receive equivalent training.

- Staff must participate in a medical monitoring program in accordance with the department's Medical Monitoring Policy.
- Staff must receive appropriate on-the-job training.
- Staff must be familiar with the *Hazardous Substance Emergency Response Plan*, written and maintained by the ESP.
- Staff must be familiar with ESP Standard Operating Procedures and have read all SOP documents that are applicable to the specific field activities being conducted, including but not limited to those referenced in this SOP.

5.0 SUPPLIES AND EQUIPMENT

The following supplies and equipment will likely be needed to safely assess the hazards at a drum site and collect samples from drums for field or laboratory analyses. Some of the equipment and supplies listed (e.g., flashpoint tester) are optional, depending upon the specific purpose and data needs of the particular investigation.

- radiation meter
- PID (Photoionization Detector)
- explosimeter
- glass thief tubes
- spoons or trowels
- non-sparking bung wrenches
- drum dolly
- 15/16" speed wrench (standard size of ring-top drum nuts and bolts)
- wide-mouth glass sample jars with Teflon-lined lids
- heavy duty ziplock bags (for packaging and storage of filled sample containers)
- paper towels
- sample labels (pre-numbered and blank)
- cooler(s) with ice
- field notebook
- drum log sheet(s)
- paint pens, grease pencils, or other device for marking drums
- Field Sheet and Chain-of-Custody Record Forms
- Level B personal protective equipment
- Level C personal protective equipment (in case downgrading is determined to be safe)
- Thermoluminescent dosimetry badge (rad badge)
- decontamination supplies for both personnel and equipment
- camera
- pH meter and/or pH paper for field analysis
- Setaflash flashpoint tester for field analysis
- Sorbent pads

6.0 PROCEDURE

6.1 Preliminary Fieldwork

- 6.1.1 Upon arrival at the drum site, a site safety meeting should be held and attended by all ESP field staff who will be directly involved in the drum investigation. The site specific HASP should be discussed. Each member of the ESP field staff directly involved in the investigation should read and sign the HASP. The HASP must then be placed in an area on site where it is readily accessible to ESP field staff.
- 6.1.2 The level of personal protection required for conducting preliminary fieldwork shall be described in the site specific HASP and must be discussed in the site safety briefing. In general, level D should be adequate protection for conducting preliminary fieldwork as long as drums are not being opened and are not leaking, and there are no other hazardous site conditions that would warrant upgrading to a more protective level of personal protection.
- 6.1.3 All field instruments shall be calibrated prior to use in accordance with the manufacturer's instructions.
- 6.1.4 A bound field notebook should be used to document all aspects of the investigation. Refer to MDNR-FSS-004 *Field Documentation* for further information on recording field notes.
- 6.1.5 An initial site survey should be conducted prior to opening any drums. The initial site survey should include taking a preliminary drum inventory, counting the number of drums at the site, marking the drums, reading and recording any labels or written information that may be on the drums, and visually inspecting the drums for evidence of corrosion, leakage, significant damage or swelling due to excessive internal pressure. In addition to recording information in a field notebook, a drum log sheet is attached to this SOP as an appendix and is recommended for use in taking the drum inventory. The attached drum log sheet has six columns: Drum ID# (the identification number assigned by the investigator), Drum Type (steel or poly), Matrix (liquid, solid, or multiphase), % Full, PID Reading, and Observations (markings, damage, leaking, missing bungs, etc.). The drum log sheet may be modified to suit individual needs. The completed drum log sheet should be incorporated into the final written investigation report, usually attached as an appendix.
- 6.1.6 If the drum contents are unknown or are known and suspected of being radioactive, then radiation screening should be performed. A radiation meter capable of detecting beta and gamma rays should be used to survey the outside of each drum. If there are any radioactive materials detected above normal background levels, the ESP field staff should evacuate the site and contact a supervisor for guidance before proceeding any further with the investigation. All

field staff who have been issued a personal thermoluminescent dosimetry badge should always wear the badge while in the field in accordance with MDNR-FSS-250 *Thermoluminescent Dosimetry Badge Management Program*.

- 6.1.7 All drums that will be either opened or sampled should be clearly marked by the ESP field staff for identification and inventory purposes. Each drum should be given a distinctive number. Paint pens, spray paint, or grease pencils are commonly used to mark drums. A marking protocol may be as simple as labeling drums 1, 2, 3 ... or may be more complex depending upon the site, the location of the drums, and the total number of drums. Drums that are obviously empty may be marked "empty", may be marked using the same numbering system as the other drums, or may simply be left unmarked.

6.2 Sample Collection

- 6.2.1 The level of personal protection required for opening drums and collecting samples shall be described in the site specific HASP and must be discussed in the site safety briefing. In general, level B protection is required for opening drums of unknown materials. If personal protection greater than level B is required, based upon preliminary information gathered about the drum contents or the situation, then ESP field staff shall not conduct the sampling and shall contact a qualified hazardous materials contractor to complete the work. The level of protection may be downgraded to level C if there is reliable information available regarding the drum contents (e.g., generator knowledge and/or site monitoring data). Only in rare instances where the drum contents are well known and determined to be of extremely low hazard would level D personal protection ever be considered appropriate for opening drums.
- 6.2.2 As previously stated, spark-resistant tools (bronze alloy bung wrenches) should always be used to open drums. Bungs should always be loosened slowly to allow for controlled venting of any gasses that may be under pressure in a drum. ESP field staff should never strike a drum with any type of metal tool. Ideally, all electronic instruments used during a drum investigation should be rated as intrinsically-safe. Equipment not rated as intrinsically-safe MUST NOT be in the work zone when drums of flammable liquids are being opened or sampled. An explosimeter should be used to monitor a work zone to ensure that explosive levels do not reach levels of concern (i.e. > 10% LEL).
- 6.2.3 Unless the drum contents are well known and organic solvents are not a concern, most drum investigations should include a screening procedure to detect the presence of organic vapors. A PID should be used to screen the headspace of a drum immediately upon opening. Care must be taken not to draw liquids into the PID instrument. PID values should be recorded on a drum log or in a field notebook. ESP field staff may also choose to record PID values on a Chain-of-Custody document, especially if samples are being collected for laboratory analysis.

6.2.4 A disposable glass thief tube is the most common tool used to collect a liquid or semi-solid from a drum. A thief tube is inserted through a bung opening or an open top of a drum and lowered to the bottom of the drum. The opening at the top of the thief tube is covered tightly with a gloved thumb to create a vacuum that allows much of the liquid to be retained in the thief tube as it is withdrawn from the drum. Using this technique, an effort should be made to collect a representative sample of the entire column of liquid in the drum from top to bottom. Wide-mouth, 8-ounce, glass jars with Teflon-lined lids are most commonly used for sample collection at drum sites. It is generally best to place sample containers on top of the drum immediately next to the bung opening to allow the sample to be drained out of the thief tube as soon as it is withdrawn from the drum to minimize spillage. Sorbent pads may also be placed under sample containers to help absorb any spillage while samples are being collected. The glass thief tube should always be discarded after use and should not be decontaminated or reused.

6.2.5 If a drum contains solid materials, equipment such as spoons, augers, core samplers, or chisels may be used to obtain a sample. Collecting a true representative sample from a drum containing a hard solid material may be difficult to obtain under normal field conditions.

6.2.6 Immediately after collection, the sample containers or jars must be labeled and placed on ice in a cooler. Refer to MDNR-FSS-003 *Sample Numbering and Labeling* for more information.

6.2.7 ESP field staff must complete a Field Sheet and Chain-of Custody Record after sample collection and prior to submitting the samples to the ESP lab for analysis. Refer to MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record* for information on completing this important piece of documentation.

6.3 Decontamination and Disposal

6.3.1 Whenever possible, ESP field staff should take enough equipment into the field to eliminate the need for field decontamination. If field decontamination is necessary, refer to MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment in the Field or Laboratory*. Additional decontamination procedures may also be described in a site specific sampling plan or HASP.

6.3.2 Contaminated disposable sampling equipment (e.g., PPE, thief tubes, or spoons) may be properly disposed of either on-site in a solid waste dumpster or at the ESP laboratory in Jefferson City. After sampling a drum, it is generally acceptable practice to break a glass thief tube in half and leave it in the drum that was sampled. However, if there is an objection to this procedure by the business or responsible party being investigated, then the contaminated thief tubes should be placed in a trash bag and discarded as solid waste either at a dumpster on-site or returned to the ESP for disposal.

- 6.3.3 Contaminated non-disposable equipment should be bagged and returned to the ESP for proper decontamination.

7.0 HANDLING AND PRESERVATION

- 7.1 Unless the contents of a drum are known, samples collected from drums should always be considered hazardous waste samples and, as such, should not be chemically preserved due to the potential for a severe reaction between the waste sample and the chemical preservative. Drum samples should be preserved on ice as soon as collected and should be packed in a cooler in such a manner to prevent container breakage.
- 7.2 If the substance collected from a drum is a water sample, not considered a concentrated hazardous waste or product sample, and not expected to react with a chemical preservative, then the ESP field staff should follow the guidance specified in Table I of MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* in the selection of sample containers and use of chemical preservatives. If there is any question that the sample does not meet all of the criteria listed above, then the ESP field staff should err on the side of caution and should not add any chemical preservative to the sample.
- 7.3 If both water samples and concentrated waste samples are collected during a drum investigation, then to help prevent cross contamination while in the field and during transportation, the water samples should be placed in one cooler while the concentrated waste samples are placed in another. If a trip blank has also been collected, it should be placed in the same cooler as the water samples.
- 7.4 For further guidance on sample handling procedures, refer to Standard Operating Procedure MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

The type and frequency of field QA/QC samples needed at any given site are generally covered by a Quality Assurance Project Plan or a site specific sampling plan. Some of the different types of field QA/QC samples that may typically be collected during a drum investigation are trip blanks, duplicate, and replicate samples. MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection* provides further guidance on QA/QC sampling procedures. Upon collection, all QA/QC samples should be preserved, labeled, and documented in accordance with MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Considerations*, MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*, and MDNR-FSS-003 *Sample Numbering and Labeling*.

9.0 REFERENCES

- MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*
- MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*
- MDNR-FSS-003 *Sample Numbering and Labeling*
- MDNR-FSS-004 *Field Documentation*
- MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*
- MDNR-FSS-106 *Field Analysis of Flash Point*
- MDNR-FSS-203 *Field Detection of Volatile Organics Using Photo and Flame Ionization Instruments*
- MDNR-FSS-204 *Field Detection of Hazardous Atmospheres Using Combustible Gas/Oxygen Detection Instruments*
- MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment in the Field or Laboratory*
- MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*
- MDNR-FSS-250 *Thermoluminescent Dosimetry Badge Management Program*

APPENDIX

DRUM LOG SHEET

DRUM LOG

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